CHAPTER 4

GENERAL MAINTENANCE

Section I. GENERAL

34. Scope

This chapter contains general maintenance information pertaining to the repair of the launcher, launching-handling rail, side truss, loading rack support, launcher transport modification kit, launcher sub-surface four-rack modification kit, CONUS C launching section modification kit, CONUS C-modified launching section modification kit, CONUS D launching section modification kit, USARAL launching section modification kit, USAREUR launching section modification kit, mobile launching section modification kit, and the launcher basic accessory kit. Refer to TM 9—1400—250—15/3 for other general maintenance procedures applicable to the launcher equipment.

35. Use

The maintenance information in the latter chapters of this manual is based on the assumption that personnel are familiar with the general maintenance procedures covered in this chapter as well as those in TM 9—1400—250—15/3. That is, specific references will not be made to individual general maintenance procedures except where danger to equipment or personnel is involved. These references are omitted because they would be too numerous. In view of this, it is especially important that personnel using this manual be familiar with the content of this chapter and TM 9—1400—250—15/3.

Section II. GENERAL MAINTENANCE PROCEDURES

36. Mechanical

a. Scribing Metal Parts. As each part is removed, its position in relation to the assembly should be established by suitably scribed reference marks if it is necessary to return it to its exact original position.

b. Cementing Gaskets. The procedures required for cementing gaskets on plates, doors, and access covers are outlined in (1) through (4) below.

(1) Clean the faying surface of the part to which the gasket is to be attached with a clean cotton cloth dampened with paint thinner. Wipe dry with a clean dry cloth.

(2) Apply a brush coat of primer cement to the cleaned surface and allow to dry until tack free.

(3) Apply a thin coat of synthetic rubber adhesive to the faying surfaces of the part and the gasket; allow the adhesive to dry until it no longer transfers to the finger when lightly touched.

(4) Carefully position the gasket before allowing the faying surfaces to contact. Press the surfaces together using maximum hand pressure or a hard roller.

c. Hoisting of the Launching-Handling Rail. It is necessary to hoist the rail when performing maintenance on some rail components. This procedure is outlined in (1) and (2) below.

(1) *Removal from the end storage racks* (fig. 56).

(*a*) Depress and hold the skip release handle in the SKIP position to disengage the hook assemblies from the track on the storage rack; move the rail along the track to the end stops; release the skip release handle.

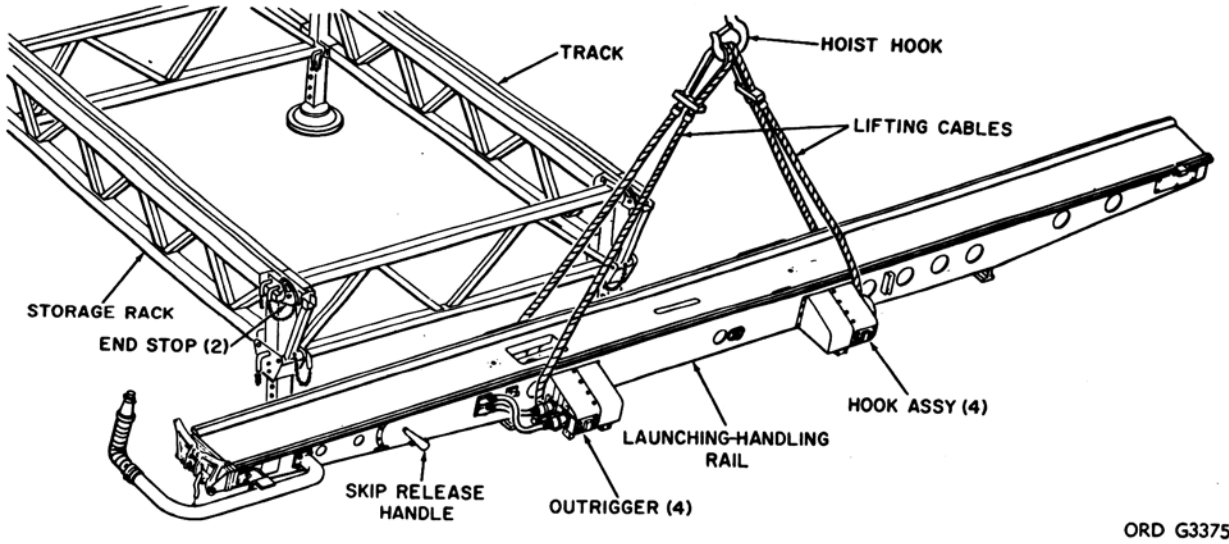


Figure 56. Launching-handling rail—removal and installation from storage rack.

(*b*) Place the lifting cables, capable of lifting a minimum of 3200 pounds, around the rail near the outriggers; attach the lifting cables to the hoist hook of a lifting device capable of lifting a minimum of 3200 pounds.

(*c*) Elevate the hoist hook enough to take up the slack in the lifting cables.

Warning: **To avoid injury by the hoisted rail, personnel should stand between the launcher and the rail near the end storage rack when performing the following step.**

(*d*) Depress the skip release handle and move the rail off the storage racks.

(*e*) Perform the required maintenance on the rail.

(2) *Installation on the end storage racks* (fig. 56).

(*a*) Place the lifting cables around the rail near the outriggers; attach the lifting cables to the hoist hook of the lifting device.

(*b*) Position the rail at the ends of the storage racks, so that the hook assemblies on the right side of the rail aline with the storage rack track.

(*c*) Depress and hold the skip release handle; carefully move the rail inboard until the hook assemblies on the right and left sides of the rail are engaged with the track; release the skip release handle.

(*d*) Disconnect the lifting cables from the hoist hook and remove the cables.

d. Use of the Erecting Beam Support. The erecting beam support (fig. 57) is a special tool used to hold the launcher erecting beam at a 12-degree angle of elevation. It provides easier access to components both inside and underneath the beam.

(1) *Installation.*

(*a*) Raise the beam as outlined in paragraph 44 sufficiently to allow the support to be placed upright under the beam.

Warning: **Failure to properly position the support under the beam before lowering the beam onto the support may result in injury to personnel and damage to equipment. To avoid this, make certain the support is not tilted and that the base of the support is flat against the ground surface.**

(*b*) Aline two 1⅛-inch diameter holes (fig. 57) in the support with the two indexing pins in the underside of the beam.

(*c*) Lower the beam as outlined in paragraph 44 onto the support, making certain the pins in the beam fully engage the holes in the support.

(2) *Removal.*

(*a*) Raise the beam as outlined in paragraph 44 sufficiently to disengage the pins from the holes in the support.

(*b*) Remove the support.

(*c*) Lower the beam to the down-and-locked position as outlined in paragraph 44.

e. Orientation when Performing Maintenance. In maintenance chapters, whenever the terms "front", "rear", "left", or "right" are used to orient personnel, it is always when standing at the rear of the launcher, facing forward.

37. Hydraulic

a. Replace all preformed packings, rings, gaskets, and seals during repair or replacement of hydraulic components.

b. Exercise extreme care in handling hydraulic components to prevent contamination from dirt, lint, water, or other hydraulic oils. Hydraulic tube assemblies and hoses should be capped when disconnected from components to be removed.

c. When installing hydraulic components, torque coupling nuts to values shown in table V, or as specifically indicated in the maintenance chapters.

Table V. Recommended Tubing Coupling Nut Torque Values

Tubing od (inches)	Mean torque value[1] (pound-inches)	
	Alum. brass or bronze	Steel
1/8	12.5	--
3/16	28.5	100
1/4	50	150
5/16	78	200
3/8	112	300
1/2	200	500
5/8	312	700
3/4	450	1000
1	600	1300

[1] overtorquing of 1/6 turn permissible.

d. Perform an operational check as outlined in TM 9-1440-250-20/1 after completing any hydraulic or electrical system maintenance.

38. Electrical

Caution: **To insure proper electrical connection of cables and terminal strips, perform continuity checks after wiring is connected or disconnected on all HERCULES Launching area equipment.**

a. Wiring Lists and Schematics. Refer to TM 9-1440-250-20/2 for electrical circuit schematics and to TM 9-1440-250-35/1 for wiring information on the launcher electrical system.

b. Protecting Cable Assemblies. Wrap all rubber-covered cable assemblies which are exposed to the rocket motor cluster blast as outlined in (1) through (4) below (ASP only).

(1) Wrap the exposed areas of the cable assembly with asbestos tape (fig. 58), overlapping each turn by one-half the width of the tape.

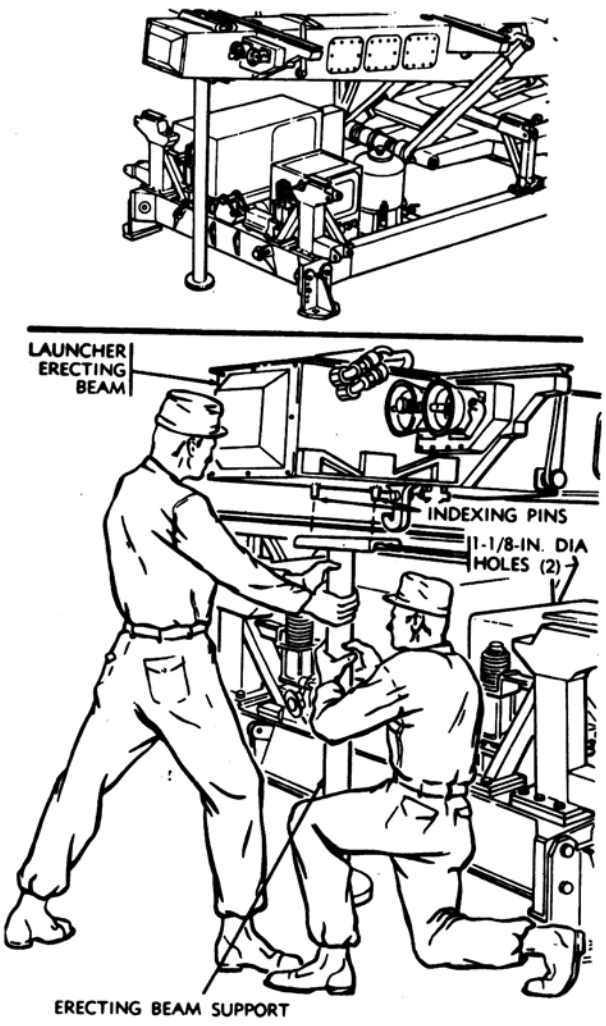


Figure 57. Erecting beam support—removal and installation.

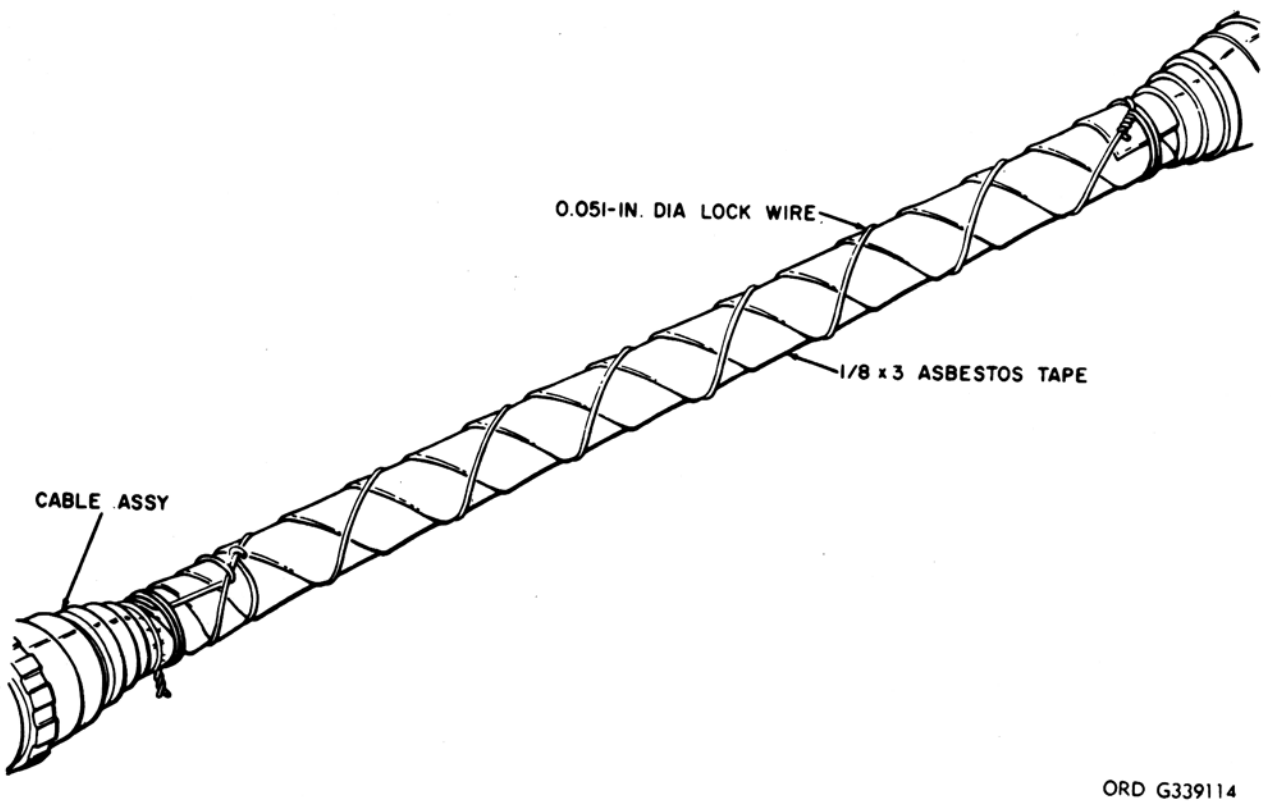


Figure 58. Cable assembly protective wrapping—typical.

(2) Tie the tape to the ends of the cable assembly with 0.051-inch diameter lockwire.

(3) Wrap the cable assembly and tape with the lockwire, allowing four complete turns of lockwire per foot of cable assembly.

(4) Secure the lockwire to each end of the cable assembly as outlined in (*a*) through (*d*) below.

(*a*) Make two complete turns of the lockwire around the end of the cable assembly.

(*b*) Pass the lockwire over the two turns and under the spiral wrapped lockwire.

(*c*) Pull the lockwire down tight and pass it around the cable assembly in the opposite direction and under the loop.

(*d*) Pull the lockwire tight; cut off the excess and bend the end back.

c. Cable Assembly Terminal Connections. Whenever any cable assembly is disconnected from a terminal board or any similar terminal connection, it is necessary to disconnect, tag, and identify each wire to correspond with its connecting terminal. When wisely used in performing less complicated wire removals, this procedure will serve to avoid repeated reference to wiring lists. Maintenance personnel should avoid attempting to tag and identify after disconnecting several wires. In order to avoid confusion, personnel should tag and identify after disconnecting each wire.

(1) *Disconnecting spade terminals.* Before attempting to disconnect any wire with a spade terminal, it is necessary to loosen the locking screw which holds the clip on the terminal block.

This permits easy removal and prevents unnecessary strain on the clip.

(2) *Connecting spade terminals.* Before connecting any spade terminal wire, loosen the locking screw sufficiently to insert the terminal into the clip. Tighten screw until the wire and spade terminal are held finger-tight against the clip.

d. Dust Covers. Some cable assemblies and electrical components have plugs or receptacles which have dust covers attached on chains. Whenever these plugs or receptacles are exposed after disconnection, they should be capped with the covers to prevent contamination by foreign matter.

39. Lubrication

a. The lubrication of parts during maintenance must be in accordance with the lubrication charts in LO 9—1400—250—20.

***Caution:* In order to avoid damage to equipment, do not lubricate electrical components.**

b. Precision parts which must be temporarily stored should be covered with a light film of oil or rust preventive compound.

40. Pneumatic Precharge Procedures

Pneumatic precharge or pressurization is required for the equilibrator accumulator (fig. 2), the hydraulic surge accumulator (fig. 121), and the compressed gas cylinder (fig. 120). Dry air or nitrogen is used to accomplish this precharge. Equilibrator accumulator and surge accumulator precharge procedures are similar and are outlined in *a* below. Precharge of the gas cylinder is outlined in *b* below.

***Caution:* Apply the precharge pressures slowly when performing *a* and *b* below.**

a. Accumulator Precharge Procedures. Perform steps (1) through (12) below only when precharging both accumulators. If only precharge of the equilibrator accumulator is required, perform steps (1) and (3) through (12) below. If only precharge of the surge accumulator is required, perform steps (2) through (12) below.

(1) Release the equilibrator accumulator hydraulic pressure as outlined in paragraph 41*a*.

(2) Release the surge accumulator hydraulic pressure as outlined in paragraph 41*b*.

(3) Remove the valve cap (fig. 61) from the air valve under the placard of AIR RESERVOIR, SURGE ACCUMULATOR, or EQUILIBRATOR ACCUMULATOR AIR FILLER (fig. 59) of the component requiring precharge.

(4) Connect the supply hose to the air valve.

(5) Adjust the pressure regulator valve as follows:

(a) When precharging the equilibrator accumulator, adjust the regulator valve to 600 psi.

(b) When precharging the gas cylinder or surge accumulator, adjust the regulator valve to 2,000 psi.

(6) Open the supply shut-off valve.

(7) Turn the swivel nut (fig. 61) a three-quarter turn counterclockwise.

(8) When the pressure specified in step (5) above has been reached, as indicated on the appropriate hydraulic pumping unit pressure gage (fig. 59), close the supply shut-off valve.

(9) Tighten the swivel nut (fig. 61) and torque to 60 ±10 pound-inches.

(10) Disconnect the supply hose (fig. 59) from the air valve.

(11) Install the valve cap (fig. 61).

(12) Close the EQUILIBRATOR SYSTEM BY-PASS valve (fig. 60) or the SYSTEM BY-PASS valve opened in steps (1) or (2) above.

b. Compressed Gas Cylinder Precharge Procedures (fig. 59). Precharge of the compressed gas cylinder does not require release of any hydraulic pressure. Perform steps *a* (3) through (11) above for the precharge of the gas cylinder.

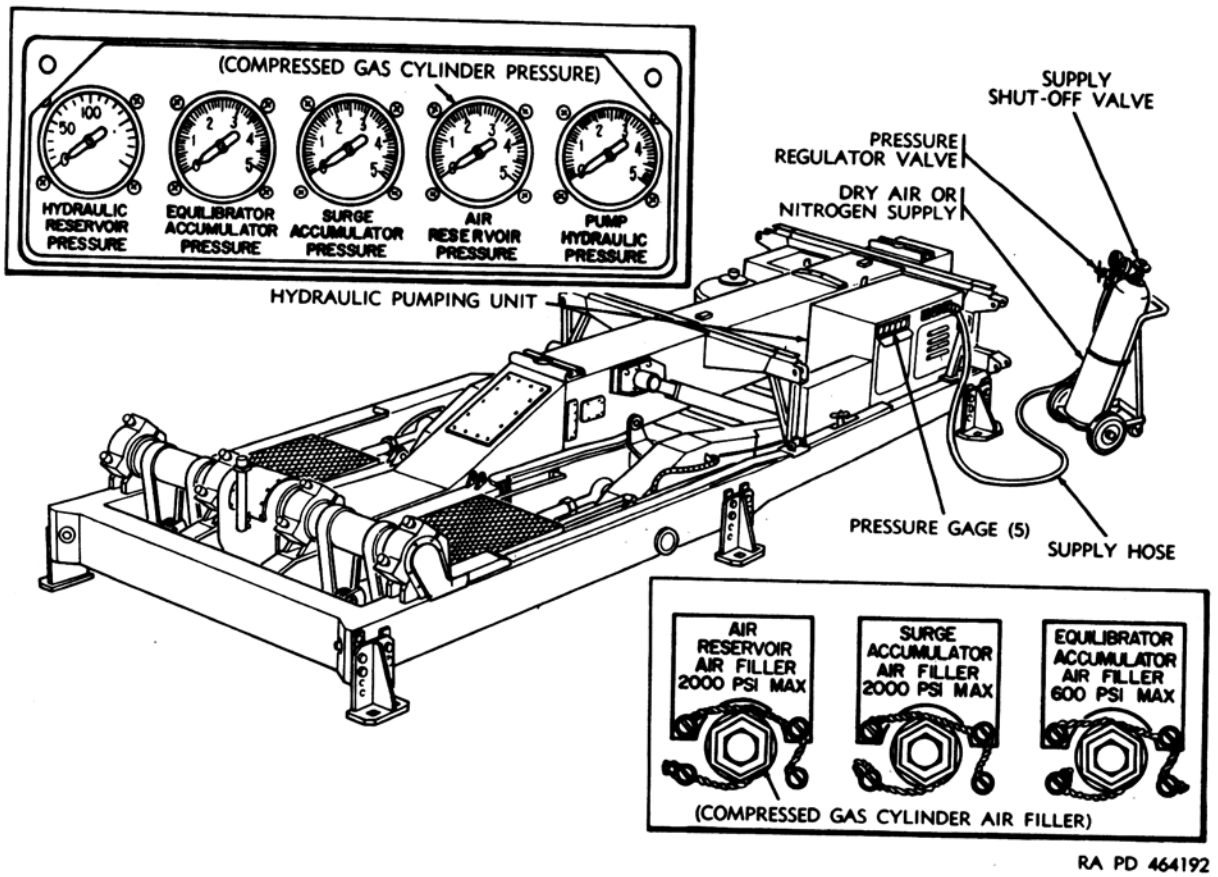


Figure 59. Pneumatic precharge procedure.

41. Hydraulic Pressure Release and Pneumatic Depressurization

a. Equilibrator Accumulator Hydraulic Pressure Release. Open the EQUILIBRATOR SYSTEM BY-PASS valve (fig. 60). This releases the hydraulic pressure in the equilibrator accumulator (fig. 2).

b. Hydraulic Surge Accumulator Hydraulic Pressure Release. Open the SYSTEM BY-PASS valve (fig. 60). This releases the hydraulic pressure in the hydraulic surge accumulator (fig. 121).

c. Hydraulic Oil Reservoir Pneumatic Depressurization. Turn the handle of the plug cock (fig. 60) to the VENT position and hold until the hydraulic oil reservoir air pressure is discharged.

d. Equilibrator Accumulator, Hydraulic Surge Accumulator, and Compressed Gas Cylinder Pneumatic Depressurization (fig. 61). The pneumatic depressurization procedures for the equilibrator accumulator, the hydraulic surge accumulator, and the compressed gas cylinder are similar. In this procedure, the swivel nut on the air valve is adjusted in a counterclockwise direction to allow depressurization. The following method is a typical depressurization procedure:

(1) Remove the valve cap from the air valve under the placard indicating the component requiring depressurization.

Warning: **To avoid bodily injury resulting from escaping pressure, do not stand in front of the air valve when performing the following step.**

(2) Open the valve by slowly turning the swivel nut counterclockwise to a maximum of 2¼ turns. Keep the valve open until all the compressed air has escaped.

(3) Close the valve by tightening the swivel nut. Torque the nut to 60 ±10 pound-inches.

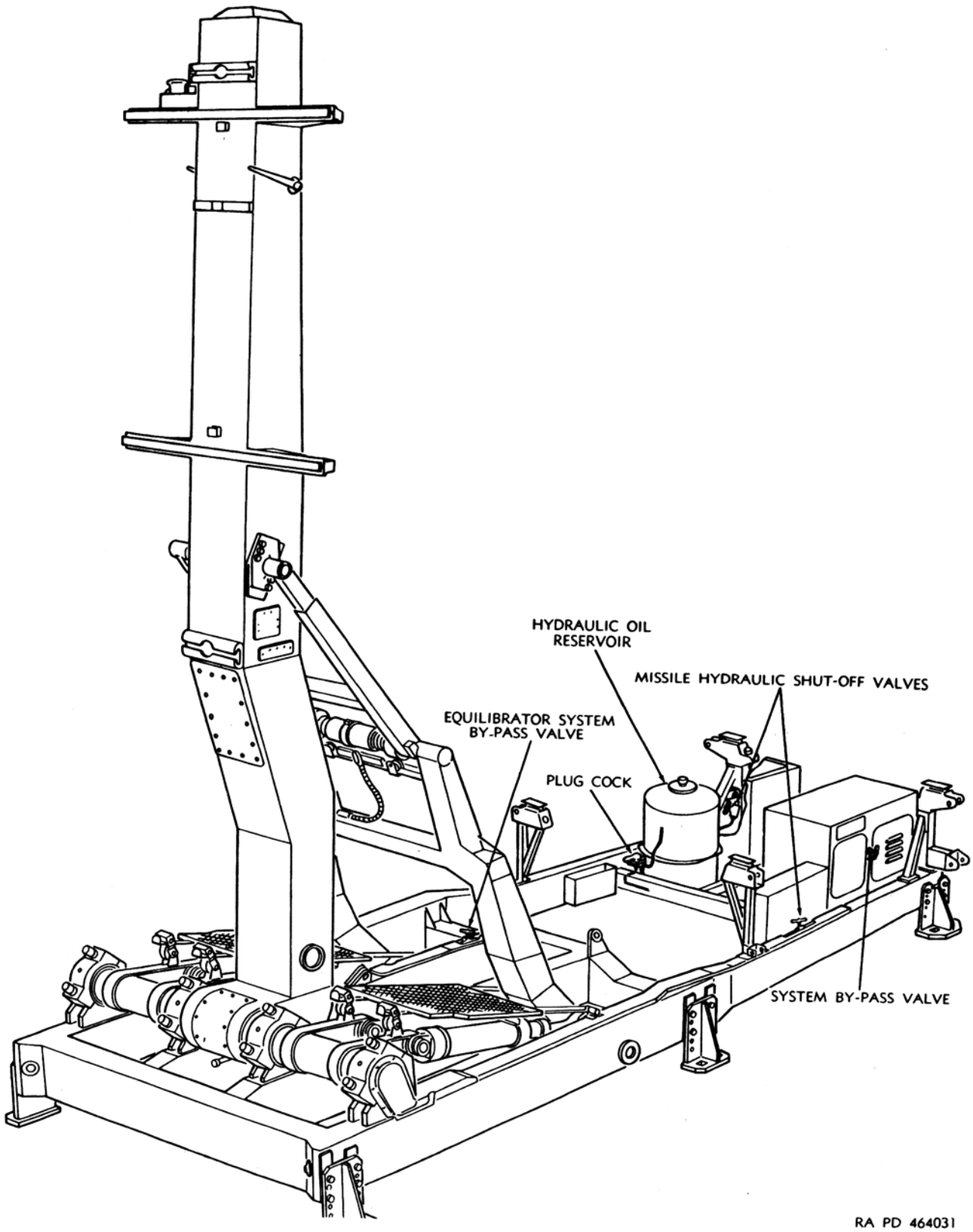


Figure 60. Manually operated hydraulic and pneumatic valves.

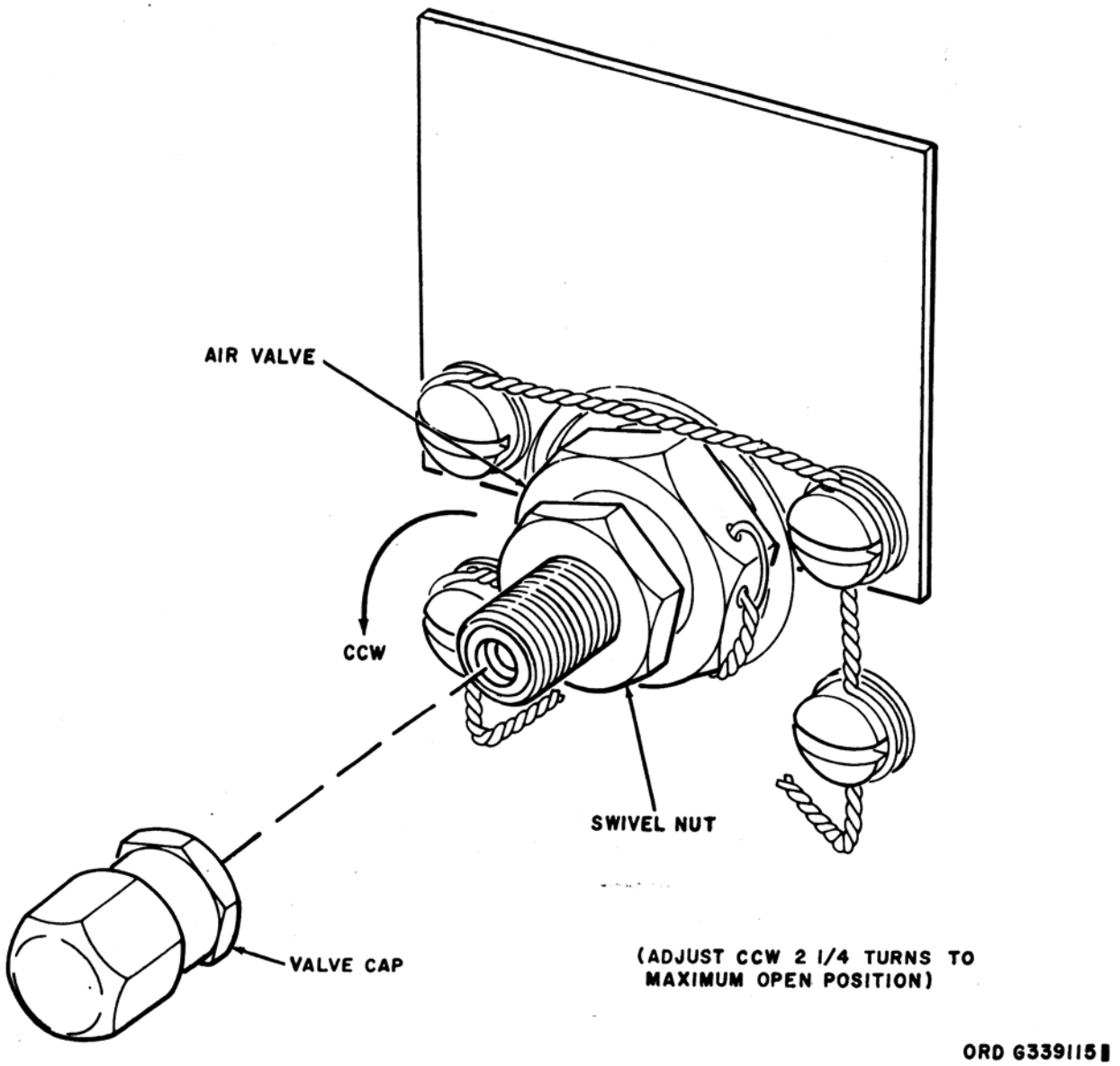


Figure 61. Pneumatic depressurization procedure—typical.

(4) Install the valve cap.

42. Launcher Erecting Beam Emergency Lowering and Locking Wedge Release

Emergency procedures are provided to lower the launcher erecting beam or release the locking wedges, for use when a power failure occurs. The hydraulic system must be bled of all dry air or nitrogen after the emergency lowering of the beam or locking wedge release procedure is performed. This bleed procedure is outlined in TM 9—1440—250—20/1.

a. Theory of Operation.

(1) *Launcher erecting beam emergency lowering.*

(*a*) An external dry air or nitrogen supply provides the emergency power source. A supply at 2000 to 3250 psi is needed to lower the

beam without a launching-handling rail and missile installed. A supply of at least 1500 psi is needed to lower the beam with a missile and a rail installed.

(*b*) The beam is lowered by the two power cylinders and by its own weight. The two equilibrator cylinders are used only to retard the decent of the beam.

(*c*) The nitrogen supply is connected to the hydraulic tube assembly leading to the rear ports of the power cylinders and to the hydraulic up-lock (fig. 10). When pressure from the nitrogen supply enters the launcher hydraulic system, it unlocks the up-lock and extends the actuating rods of the two power cylinders. The hydraulic fluid on the front side of the pistons of these two cylinders is forced out through the internal dashpots and restrictor check valves inside the cylinders. From the cylinders, this pressure is directed through a speed control valve in hydraulic panel. The pressure then passes through port 2 of the up-down solenoid valve and returns to the hydraulic oil reservoir. The hydraulic fluid on the front side of the pistons of the two equilibrator cylinders is forced out through the internal dashpots and restrictor check valves of the cylinders and into the reservoir through the open EQUILIBRATOR SYSTEM BY-PASS valve. The fluid restrictions permit the beam to descend slowly.

(*2*) *Locking wedge release.*

(*a*) To unlock the two locking wedges, the nitrogen supply is connected to the hydraulic tube assembly leading to the rear ports of the two locking wedge hydraulic cylinders.

(*b*) When pressure from the nitrogen supply enters the hydraulic system, it extends the actuating rods of the hydraulic cylinders, moves the wedges toward the front of the beam, and lowers the locking wedge adjusters (fig. 41). The fluid on the front side of the hydraulic cylinder pistons flows through port 1 (fig. 10) of the locking wedge solenoid valve to the reservoir.

b. Emergency Lowering Procedure. Procedures for emergency lowering of the beam require using an external dry air or nitrogen supply, together with certain other parts necessary for a proper hookup. Refer to table VI for a list of these parts.

Table VI. Parts Required for Launcher Erecting Beam Emergency Lowering and Locking Wedge Release Hookups

Part No.	Nomenclature	Quantity
8531309	Cylinder-return tube plug	1
AIR-AN806-8	Cylinder-down tube plug	1
AN816-12-8	Outlet valve nipple	1
AN816-7	Inlet valve nipple	1
8161451	Inlet hose reducer	1
MS28759-12-0500	Outlet hose	1
MS28759-8-1000	Inlet hose	1
8166713	Inlet valve	1
8169440	Outlet valve	1

(1) Observe the general precautions described in paragraph 58 *a* and *b*.

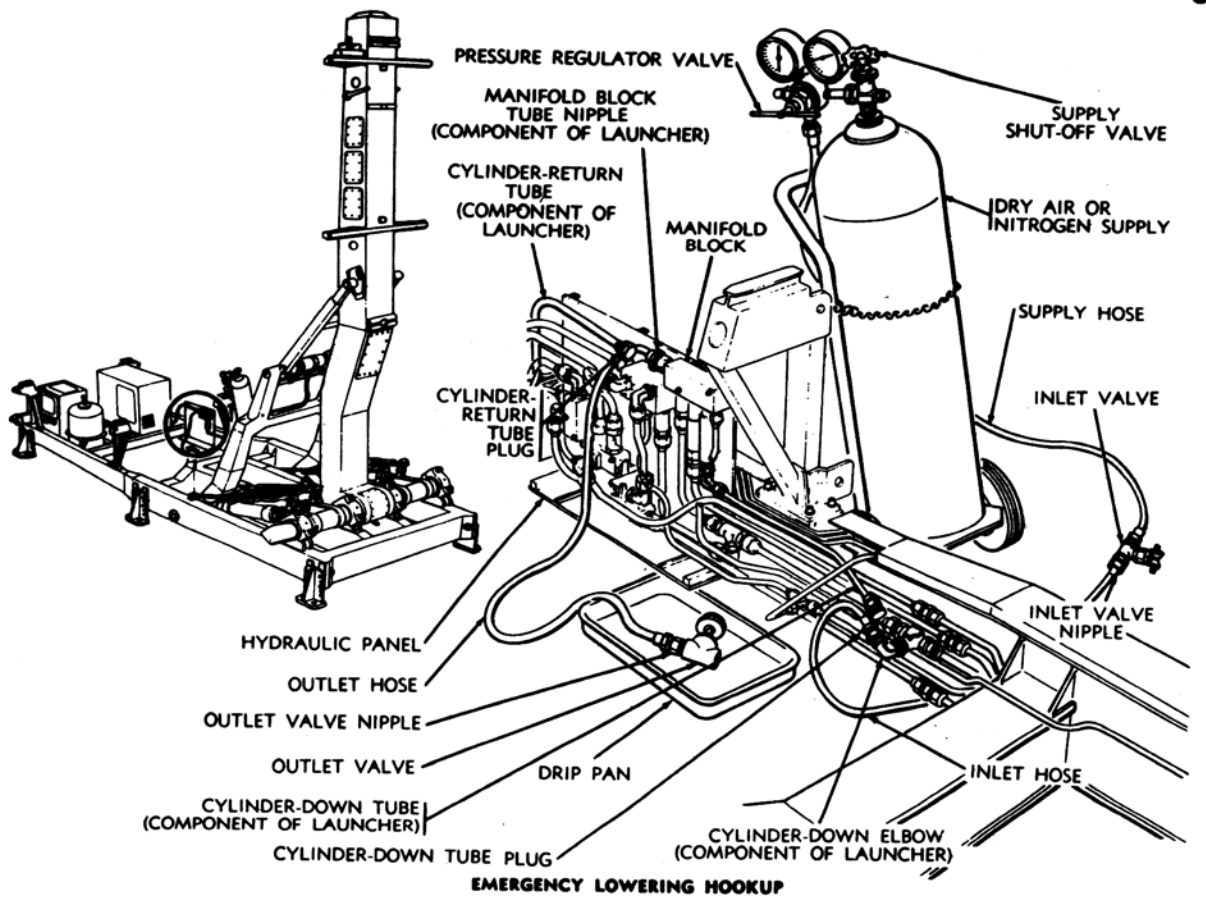
(2) Release the equilibrator accumulator hydraulic pressure by opening the EQUILIBRATOR SYSTEM BY-PASS valve (fig. 60).

(3) Depressurize the hydraulic oil reservoir by turning the handle of the plug cock to the VENT position and holding until all pressure is discharged.

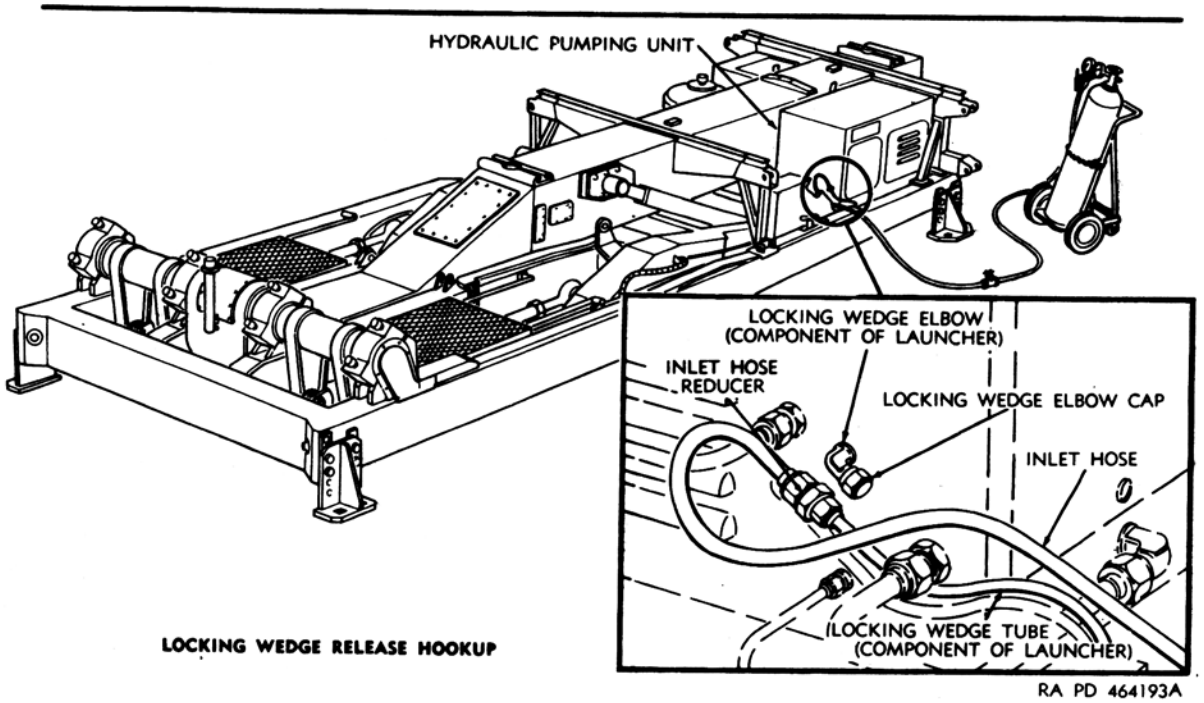
(4) Place a drip pan (fig. 62) under the cylinder-down elbow and disconnect the cylinder-down tube from this elbow.

(5) Install the cylinder-down tube plug on the cylinder-down tube.

(6) Install the inlet valve nipple on the inlet valve.



EMERGENCY LOWERING HOOKUP



LOCKING WEDGE RELEASE HOOKUP

RA PD 464193A

Figure 62. Launcher erecting beam emergency lowering and locking wedge release-hookups.

(7) Connect the inlet hose to the cylinder-down elbow and to the inlet valve.

(8) Connect the inlet valve to the supply hose.

Warning: **Use a dry air or nitrogen supply only. Any other external supply may result in an explosion.**

(9) Close the inlet valve.

(10) Remove panel cover (fig. 154).

(11) Place a drip pan under the manifold block (fig. 62) in the hydraulic panel and disconnect the cylinder-return tube from the manifold block tube nipple.

(12) Install the cylinder-return tube plug on the cylinder-return tube.

(13) Connect the outlet hose to the manifold tube nipple and to the outlet valve. Use the outlet valve nipple to connect the outlet valve to the outlet hose.

(14) Close the outlet valve. Place the valve inside the pan to prevent contamination of valve.

(15) Adjust the pressure regulator valve as follows:

(*a*) When a missile and rail are installed on the launcher, adjust the regulator valve to 1500 psi.

(b) When the launcher has neither a missile nor rail installed, adjust the regulator valve between 2000 and 3250 psi.

(16) Open the supply shut-off valve.

Warning: **The beam will descend when the following step is performed. To avoid injury, personnel should stand clear of the beam.**

(17) Open the inlet valve and observe the descending beam. Close the inlet valve when the beam is halfway down.

(18) Close the supply shut-off valve and inlet valve when the beam is down and locked.

(19) Depressurize the hydraulic oil reservoir by turning the handle of the plug cock (fig. 60) to the VENT position and holding until all pressure is discharged.

(20) Open the outlet valve and release the nitrogen trapped in the hydraulic lines (fig. 62).

(21) Disconnect the supply hose from the inlet valve.

(22) Open the inlet valve to release the trapped nitrogen in the inlet hose.

(23) Disconnect the inlet hose from the cylinder-down elbow.

(24) Remove the cylinder-down tube plug and connect this tube to the cylinder-down elbow.

(25) Torque coupling nut of the cylinder-down tube to 500 pound-inches.

(26) Disconnect the outlet hose from the manifold tube nipple.

(27) Remove the cylinder-return tube plug and connect this tube to the manifold tube nipple.

(28) Torque coupling nut of the cylinder-return tube to 1000 pound-inches.

(29) Install the panel cover (fig. 154).

(30) Pressurize the hydraulic oil reservoir to 20 psi by turning the handle of the plug cock (fig. 60) to the AIR position.

(31) Close the EQUILIBRATOR SYSTEM BY-PASS valve.

(32) Perform the air bleed procedure as outlined in TM 9—1440—250—20/1.

c. Locking Wedge Release Procedure.

(1) Observe the general precautions described in paragraph 58 *a* and *b*.

(2) Relieve hydraulic and pneumatic pressures as outlined in paragraph 41, *a*, *b*, and *c*.

Note. **Two identical externally-mounted elbows are located near each other on the rear of the hydraulic pumping unit. The upper one is the locking wedge elbow (fig. 62). Locate this elbow before performing the following step.**

(3) Place a drip pan under the locking wedge elbow and disconnect the locking wedge tube from the elbow.

(4) Install the locking wedge elbow cap on the elbow.

(5) Connect the inlet hose to the locking wedge tube with the inlet hose reducer.

(6) Connect the inlet hose to the inlet valve and connect the inlet valve to the supply hose.

Warning: **Use a dry air or nitrogen supply only. Any other external supply may result in an explosion.**

(7) Adjust the pressure regulator valve between 2000 and 3250 psi.

Warning: **To avoid injury, personnel should keep hands clear of the area around locking wedges when performing the following step.**

(8) Open the inlet valve and supply shut-off valve. The wedges will unlock.

(9) Depressurize the hydraulic oil reservoir by turning the handle of the plug cock (fig. 60) to the VENT position and holding until all pressure is discharged.

(10) Close both the inlet valve (fig. 62) and supply shut-off valve.

(11) Disconnect the inlet hose and the inlet hose reducer from the locking wedge tube.

(12) Remove the wedge elbow cap.

(13) Connect the wedge tube to the elbow. Torque the coupling nuts to 300 pound-inches.

(14) Open the inlet valve and release the trapped nitrogen in the supply hose.

(15) Close the EQUILIBRATOR SYSTEM BY-PASS valve (fig. 60) and the SYSTEM BY-PASS valve.

(16) Pressurize the hydraulic oil reservoir to 20 psi by turning the handle of the plug cock to the AIR position.

(17) Perform the air bleed procedure as outlined in TM 9–1440–250–20/1.

43. (Deleted)

Figures 63 and 64 (Deleted)

44. (Deleted)

44.1. Annual Check of the Monorail Launcher and the Launching-Handling Rail

Use the launcher electrical function tester to perform the annual checks of the monorail launcher and the launching-handling rail.